Predicting Short versus Long Hospital Stay for Navy Personnel with a Diagnosed Mental Health Problem: A Replication

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Summary

Problem

In a recent investigation of short versus long hospital stays of active duty, enlisted Navy personnel with a back problem, Kilbourne, Chesson, and Hilton (1988) found that 85% of all hospital stays were short (30 days or less) and were associated with less-severe back problems, direct admissions, and later years of hospitalization. An interesting question raised by the Kilbourne, et al. (1988) study concerns the degree to which their findings with hospitalized back-problem cases generalize to other kinds of hospitalized cases.

Objective

The purpose of the present study was to examine the relationship between mental health diagnosis (psychotic and nonpsychotic), certain hospital factors (i.e., years of hospitalization, direct versus transfer admission, first versus multiple admission cases) and length of hospital stay for active duty, enlisted Navy personnel.

Data

The sample (N=30,340) consisted of all hospitalized cases of active duty, enlisted Navy personnel between 1981 and 1984, inclusive, with a mental health problem as the primary diagnosis.

Results

Results indicated that a small percentage of mental health problem cases accounted for a disproportionate number of total hospital days, and that longer hospital stays were generally associated with psychotic diagnoses and Air Force, Army, or Navy medical transfers. Additionally, nonpsychotic cases (i.e., alcoholism cases), direct admissions, and first admission cases were more likely to indicate longer hospital stays during the second two-year period of the study than during the first two-year period of the study.

Conclusions

Similar to the Kilbourne, et al. (1988) study of hospitalized back problems, the present study found that three variables--diagnosis severity, year of hospitalization, and type of admission--were associated with length of hos-

pital stay for mental health problem cases. However, for mental health problem cases, the direction and magnitude of these relationships were not exactly the same, and admission history was more important in the present study than in the back problem study. It was also concluded that different hospital practices or rules concerning length of hospital stay apply to non-psychotic versus psychotic cases.

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Introduction

In a recent study of short versus long hospital stays of active duty enlisted Navy personnel with a back problem between 1974 and 1984, Kilbourne, Chesson, and Hilton (1988) found that 85% of all hospital stays were short (30 days or less) and were associated with less-severe back problems, direct admissions, and more recent years of hospitalization. Longer hospital stays were associated, in turn, with more-severe back problems, Air Force, Army, or Navy medical transfers, and earlier years of hospitalization. An interesting question raised by the Kilbourne, et al. (1988) study concerns the degree to which their findings with hospitalized back problem cases generalize to other kinds of hospitalized cases. Have Navy hospital administrators generally attempted to shorten the length of hospital stay of all inpatients or just certain types of inpatients?

Consider, for example, mental health problems. A substantial body of empirical research indicates that psychotic disorders are more likely than other mental disorders to be severe, chronic, and to involve extended institutionalization (Antonovsky, 1983; Diagnostic and Statistical Manual of Mental Disorders [DSM-III-R], 1987; Lehman, Haroutun, Babigian, & Reed, 1984; Manderscheid & Barrett, 1987; Munves, Trimboli, & North, 1983). Yet, the general trend in hospitalization patterns for mental health problems in the civilian sector has been to shorten length of stay, even for psychotic disorders, and to emphasize the importance of aftercare (e.g., half-way houses and family support [Mattes, 1982]). However, the U.S. Navy is not structured organizationally to provide the same kind of preventive services, aftercare, and community support as the civilian sector.

The purpose of the study reported herein was to examine the extent to which the Kilbourne, et al. (1988) findings on short versus long hospital stay

for back problem cases would generalize to short versus long hospital stay for mental health problem cases. Thus, based on the Kilbourne, et al. (1988) findings, it was hypothesized that: 1) most active duty, enlisted Navy personnel with a mental health problem as the primary diagnosis would spend 30 days or less in the hospital; 2) active duty, enlisted Navy personnel with a psychotic diagnosis would have longer hospital stays than those with a nonpsychotic (i.e., less severe) diagnosis; 3) recency of hospitalization would be negatively related to length of hospital stay (i.e., a trend toward shorter lengths of hospital stay); and 4) type of admission (direct admission versus Air Force/Army/Navy medical transfer versus other medical transfer) would be related to length of hospital stay, such that Air Force, Army, and Navy medical transfer patients would generally be associated with longer hospital stays.

Methods

Subjects

The sample (N=30,340) consisted of all hospitalized cases of active duty, enlisted Navy personnel between 1981 and 1984, inclusive, with a mental health problem as the primary diagnosis. The majority of the sample was white (86%), male (91%), not married (56%), and had twelve years of education (71%). The average age was 24.9 (sd=5.9, range=17-60 years). The median paygrade was E-3 (range=E-1 to E-9). Additionally, the sample was characterized by the following: 1) the average length of hospital stay was approximately 16 days (sd=21.1), 2) mental diagnoses were 90% nonpsychotic and 10% psychotic, 3) approximately 50% of the cases were hospitalized between 1981 and 1982 while the other 50% were hospitalized between 1983 and 1984, and 4) 95% of the mental problem cases were direct admissions, 4% were Air Force, Army, or Navy transfers, and 1% were other medical transfers.

Procedures

Data Collection Procedures. Data were obtained from the Navy Enlisted Career/Medical History File (NECMHF). NECMHF is based on two compiled files. One is the Service History File, which consists of demographic and military-service history data from Navy Military Personnel Command in Arlington, Virginia. The other is the Medical History File, which contains hospitalization, death, Medical Board action, and Physical Evaluation Board action data from Naval Medical Data Services Center in Bethesda, Maryland. NECMHF is compiled

and maintained by the Naval Health Research Center, San Diego, California (Garland, Helmkamp, Gunderson, Gorham, Miller, McNally, & Thompson, 1987).

Coding Procedures. Number of days in the hospital was collapsed to a categorical ordinal variable (short hospital stay [30 days or less] versus long hospital stay [31 days or more]) in order to create two empirical groups that would permit replication of the Kilbourne, et al. (1988) study and to facilitate comparison with other ordinal variables. Severity of mental-problem primary diagnosis at time of hospitalization was treated as a categorical ordinal variable (psychotic diagnosis [more likely to be severe and chronic] versus nonpsychotic diagnosis [less likely to be severe and chronic]).[2] Year of hospitalization (years of occurrence) was treated as a categorical ordinal variable (first two years [1981 through 1982] versus second two years [1983 through 1984]) and type of admission was treated as a nominal variable with three categories (direct admission versus Air Force/Army/Navy medical transfer versus other medical transfer). A control variable--admission history of all mental-problem primary diagnoses (first-admission case versus multiple-admission case)--was treated as a categorical variable.

Results

As in the Kilbourne, et al. (1988) study of back problem cases, an initial inspection of the data indicated a highly skewed (positive) frequency distribution of number of days in the hospital for mental health problem cases. Approximately 80% of all mental health problem cases were in the hospital for 30 days or less, and accounted for 31% of total hospital days. The remaining 20% of mental health problem cases, which were in the hospital 31 days or more, accounted for 69% of total hospital days.

Cross-tabular frequency distributions of length of hospital stay by diagnosis severity (psychotic versus nonpsychotic), year of hospitalization (first two-year period versus second two-year period), and type of admission (direct admission versus Air Force/Army/Navy medical transfer versus other medical transfer) revealed significant relationships among these variables (the p values for all the chi square tests were $\leq .0001$). The proportional reductions of error (Kendall's tau-b)[3] in predicting length of hospital stay from each of the predictor variables were significant ($p<.0001$). Knowledge of years of hospitalization alone would reduce the errors in predicting length of hospital stay by 30%, while knowledge of diagnosis severity alone would reduce

prediction errors by 9%, and knowledge of admission type alone would reduce prediction errors by 4%.

Using the partial tau-b procedure to control for a third variable, both diagnosis severity and type of admission were found to be statistically independent predictors of hospital stay (Agresti & Agresti, 1979; Blalock, 1979). The partial tau-b procedure revealed that the association between length of hospital stay and year of hospitalization was due in part to the effects of diagnosis severity, type of admission, and admission history. Controlling diagnosis severity reduced the association between length of hospital stay and year of hospitalization by 43% (from .30 to .17), while type of admission and admission history each individually reduced that association by 33% and 20%, respectively. Table 1 shows the relationships between each of the predictor variables and length of hospital stay when controlling for the other two predictor variables and the control variable, admission history.

Table 1

Effect of Control Variables on Relationships of Medical Discharge Disposition with Predictor Variables[a]

		Control Variables			
	Length of Hospital Stay	Diagnosis Severity	Hospitalization Year	Type of Admission	Admission History
Diagnosis Severity	.09	--	.13	.16	.11
Hospitalization Year	.30	.17	--	.20	.24
Type of Admission	.04	.06	.06	--	.06

[a]All table values represent tau-b coefficients of Length of Hospital Stay with the row (predictor) variables.

The tau-b analyses uncovered some important relationships. One main effect was that psychotic cases generally spent more time in the hospital than nonpsychotic cases. The other main effect was that Air Force, Army, or Navy transfer cases were generally hospitalized longer than were direct admissions or other medical transfers (not Air Force, Army, or Navy). Additionally, year of hospitalization interacted with severity of diagnosis, type of admission, and admission history. Nonpsychotic cases were hospitalized longer during the second two-year period than the first two-year period while the length of stay of psychotic cases remained relatively the same across the same time period. Direct admission cases (about 95% of all cases) were hospitalized substantially longer during the second two-year period than the first two-year period while the length of stay of transfer cases increased at a lesser rate. First-admission cases were hospitalized substantially longer during the second two-year period than during the first two-year period while the length of stay of multiple admission cases increased at a lesser rate. Table 2 shows the above interaction effects of year of hospitalization.

Table 2

Interaction Effects with Years of Hospitalization

	Percent of Cases with ≥ 31 Days in the Hospital	
	1981-82	1983-84
Diagnosis Severity		
Nonpsychotic	7.5	35.0
Psychotic	33.5	34.1
Type of Admission		
Direct	9.6	35.1
AF/Army/Navy	24.7	43.8
Other medical	16.0	25.2
Admission History		
First-admissions	9.5	37.6
Multiple-admissions	14.9	25.9

The interactions uncovered in the partial tau-b analysis suggested that psychotic and nonpsychotic cases may not be subject to the same formal and/or informal rules regarding length of hospital stay. Therefore, separate multiple regressions for psychotic and nonpsychotic cases were computed, in which year of hospitalization, type of admission, and admission history were regressed on actual number of days spent in the hospital. Year of hospitalization and admission history were treated as single-category dichotomous variables while the three admission types were represented by a series of dummy variables (Blalock, 1979). Not only were the regression coefficients for psychotic and nonpsychotic cases dissimilar, but the proportions of variance explained by the models differed significantly (R^2=.01 for psychotic cases; R^2=.15 for nonpsychotic cases). Year of hospitalization explained 14% of the variance for nonpsychotic cases. A regression analysis was then applied to all the cases (psychotic and nonpsychotic) with severity of diagnosis as a dichotomous independent variable. The total explained variance was 14%. Thus, year of hospitalization essentially helped to explain the length of hospital stay for nonpsychotic cases (about 90% of the cases) and appeared to be irrelevant for psychotic cases.[4] Table 3 shows the average number of days hospitalized for all cases as a function of each year of hospitalization. Table 4 shows the multiple regression analysis for nonpsychotic cases that predicts length of hospital stay.

Given the effect of year of hospitalization upon nonpsychotic cases alone, a closer look at the data was undertaken to ascertain whether that effect was characteristic of all nonpsychotic cases or just certain nonpsychotic cases. Table 5 shows the strong relationship between year of hospitalization and short versus long hospital stay for alcoholics only (52% of all nonpsychotic cases [n=14,065]). Separate multiple regressions for alcoholism cases and nonpsychotic, nonalcoholism cases were then computed, in which year of hospitalization, type of admission, and admission history were regressed on actual number of days spent in the hospital. Year of hospitalization and admission history were again treated as single-category dichotomous variables while the three admission types were represented by a series of dummy variables (Blalock, 1979). Not only were the regression coefficients for alcoholism and nonpsychotic, nonalcoholism cases dissimilar, but the proportions of variance explained by the models differed significantly (R^2=.43 for alcoholism cases;

Table 3

Mean Days of Hospitalization as a Function of Year of Hospitalization and Diagnosis Severity

Psychotic and Nonpsychotic

Year of Hospitalization	Days in the Hospital		
	Mean	Std Dev	Cases
1981	7.66	17.35	7,400
1982	11.76	20.57	7,582
1983	21.88	22.22	7,642
1984	21.46	20.28	7,716
Total	15.78	21.11	30,340

Psychotic Only

Year of Hospitalization	Days in the Hospital		
	Mean	Std Dev	Cases
1981	29.15	34.78	874
1982	31.76	37.15	783
1983	31.96	39.44	750
1984	27.52	29.52	723
Total	30.10	35.48	3,130

Nonpsychotic Only

Year of Hospitalization	Days in the Hospital		
	Mean	Std Dev	Cases
1981	4.78	10.45	6,526
1982	9.46	16.18	6,799
1983	20.79	19.13	6,892
1984	20.84	18.96	6,993
Total	14.13	18.05	27,210

Table 4

Forced-Entry Multiple Regression Analysis Predicting Length of Hospital Stay for Nonpsychotic Cases Only

Variable	Multiple R	R^2	Beta	t value	p value
Hospital Year	.38	.14	.38	67.3	<.0001
Other Medical Transfer	.39	.15	.02	3.4	<.001
AF/Army/Navy Transfer	--	--	.08	13.1	<.0001
Admission History	.39	.15	-.03	-4.4	<.0001

R^2=.03 for nonpsychotic, nonalcoholism cases). Year of hospitalization explained 42% of the variance for alcoholism cases but only .004% of the variance for nonpsychotic, nonalcoholism cases.

Discussion

The present study obtained general support for three of the four hypotheses. Hypothesis 1 was supported--most (80%) active duty, enlisted Navy personnel with a mental health problem as the primary diagnosis spent 30 days or less in the hospital. Hypothesis 2 was supported--psychotic as opposed to nonpsychotic cases were associated with longer hospital stays, although diagnosis severity interacted in some instances with year of hospitalization. Hypothesis 3 was not supported--shorter hospital stays were not associated with more recent years of hospitalization, but rather with earlier years of hospitalization. Hypothesis 4 was supported--Air Force, Army, and Navy medical transfers were associated with longer hospital stays, although an interaction with year of hospitalization emerged which modulated that effect in some cases. Thus, similar to the Kilbourne, et al. (1988) study of hospitalized back problem cases, the present study of mental health problem cases found that three variables--diagnosis severity, year of hospitalization, and type of admission--were associated with short versus long hospital stay. However, the direction and effect of these relationships were not the same in the two studies, and admission history was an important factor for mental health problems, but not for back problems.

Table 5

The Relationship Between Year of Hospitalization and Hospital Stay for Alcoholism Cases

Hospital Stay	Year of Hospitalization: 1981-1982	Year of Hospitalization: 1983-1984	
Short (<30 days)	6,103 (67%)	2,989 (33%)	9,092
Long (≥31 days)	556 (11%)	4,417 (89%)	4,973
			14,065

Kendall's tau-b = .54, $p<.01$.[a]

[a] The above relationship between short versus long hospital stay and year of hospitalization for alcoholism cases was reduced by 17% when controlling for admission history (summary tau-b=.45). Alcoholism cases that were first-admission cases were more likely to stay longer in the hospital than multiple-admission cases. The relationship between short versus long hospital stay and year of hospitalization was also reduced by 50% when controlling for specific hospital location. That reduction was entirely attributable to the fact that some hospitals do not keep alcoholism cases longer than 30 days. Therefore, in some cases a ceiling effect restricted the range of days in the hospital and precluded an assessment of short versus long hospital stay relative to the coding procedure.

The most striking finding in the present study was that the direction of the relationship between year of hospitalization and length of hospital stay was the opposite of what Kilbourne, et al. (1988) reported for a sample of back problem cases. In the back-problem study, partial tau-b analyses indicated that more recent years of hospitalization were associated independently with shorter hospital stays. In the present study of mental health problem cases, partial tau-b analyses indicated that more recent years of hospitalization were associated, for particular types of cases, with longer hospital stays. For example, nonpsychotic cases, direct admissions, and first admissions were more likely to have longer hospital stays during the second two-year period than the first two-year period of the study.

As in the Kilbourne, et al. (1988) study, when diagnosis severity, year of hospitalization, and type of admission were entered into a multiple regression analysis, they continued to predict the full range of days of length of hospital stay, not just short versus long hospital stay. However, a close inspection of the data indicated that those findings were primarily true of certain nonpsychotic cases (i.e., alcoholism cases). Nevertheless, these findings support the Kilbourne, et al. (1988) contention that hospital policy and/or practices have a differential effect on different parameters of hospital stay. For example, year of hospitalization and type of admission are differentially related to length of hospital stay as a function of both the type of medical problem (e.g., psychotic versus nonpsychotic, mental versus physical) and the nature of measurement employed.

In the present study, year of hospitalization had a stronger effect upon length of hospital stay than in the Kilbourne, et al. (1988) study of back problems, primarily because of its strong effect on alcoholism cases. On the other hand, type of admission had a somewhat weaker effect upon length of hospital stay in the present study than in the Kilbourne, et al. (1988) study of back problems. The effect of severity of diagnosis was relatively the same for back problems and mental health problems alike. More severe problem cases generally spent longer in the hospital, although that relationship varied to some degree with hospital policy and/or practices.

When the Kilbourne, et al. (1988) study on back problems is considered in light of the present study on mental health problems, a compelling case can be made. Hospital policies and/or practices, formal and informal, have the ef-

fect of either increasing or decreasing hospital costs. While the costs associated with the hospitalization of active duty, enlisted Navy personnel with a back problem appear to be going down (Kilbourne, et al., 1988), even if only by utilizing medical holding companies to insure a partial return to duty, the inverse is true of mental health problems. Based on the present sample, we can conclude that the length of hospital stay of active duty, enlisted Navy personnel with an alcoholism problem has increased and the longer hospital stays of psychotic cases has remained about the same.

An important conclusion is that different rules or practices influence the length of hospital stay of psychotic versus nonpsychotic cases. Concerning psychotic cases, the generally longer but also more variable hospital stays suggests different degrees of severity and/or discharge policies. The marked variability in length of hospital stay of psychotic patients was in fact related to a markedly skewed distribution of days in the hospital. Approximately two-thirds of psychotic cases spent 30 days or less in the hospital. The remaining one-third of psychotic cases spent between 31 and 307 days in the hospital. Thus, the extreme tail of the distribution of psychotic cases probably reflects both the practice of: 1) keeping more severe psychotic cases in the hospital for a longer period of time, and 2) extending hospital stays of psychotic individuals who are in the process of appealing discharge from the Navy. Concerning nonpsychotic cases, it was in fact only alcoholism cases that indicated a dramatic upward movement toward longer hospital stays, which probably reflects the policy or practice to hospitalize alcoholism cases for long-term inpatient therapy and medical treatment rather than to treat them on an outpatient basis.

These conclusions prompt the following cost-benefit recommendations. Research and practice in the civilian sector with nonpsychotic and psychotic patients has generally shown that limiting hospitalization is both therapeutic and cost-effective. For those individuals requiring hospitalization, brief hospitalization followed by adequate aftercare and family support result in equal or better outcomes than long-term hospitalization (Archer & Gruenberg, 1982; Mattes, 1982). Similarly, hospital costs can be reduced by implementing procedures which limit the hospital stay of individuals with psychotic problems who are appealing their administrative discharge from the U.S. Navy. Lastly, by halting the trend to hospitalize alcoholism cases (which are associated with longer hospital stays) and, alternatively, treating such cases

in special alcoholism centers, overall mental health care costs can be reduced and scarce hospital resources more effectively distributed. Because of their size alone, Navy hospitals generally have higher operational overheads than special treatment facilities.

Footnotes

[1] Brock Kilbourne is a research associate with the National Research Council, National Academy of Sciences, and a licensed psychologist (CA. #PV10467). Jerry Goodman is a sociologist and statistical consultant with the Naval Health Research Center, San Diego, CA. Susan Hilton is a research psychologist and a member of the Health Psychology Department, Naval Health Research Center.

[2] Within the mental disorders section of the Navy Enlisted Career/Medical History File, the psychotic diagnostic codes or those including psychotic features were: Organic psychoses (approximately 1% of all cases), schizophrenia (5%), affective psychosis (2%), other psychoses (2%). The nonpsychotic diagnostic codes were: neuroses (5%), personality disorders (15%), alcoholism (47%), drunkenness (6%), transient situational disturbances (10%), and other nonpsychotic disorders (7%).

[3] Kendall's tau-b has a proportional reduction in error interpretation and can be used to compute a summary partial tau-b measure (tau-b-bar) to control for third variables of any scale (Agresti & Agresti, 1979).

[4] Since the psychotic diagnosis category is an aggregation of nine specific diagnoses with psychotic features, a similar regression analysis was performed for each subcategory diagnosis to insure that findings for the psychotic cases in toto were not masked by different patterns for the various psychotic diagnostic subcategories. The regression analyses better explained length of hospital stay for organic psychoses than for functional psychoses. The variance explained for all organic psychoses, which represented approximately one-seventh of all psychotic cases, was 6.6%. The highest significant explained variance was for psychoses associated with physical conditions other than intracranial or cerebral (R^2=.11) and represented almost half of the organic psychotic cases. On the other hand, functional psychoses, which represented six-sevenths of the psychotic cases, had an overall explained variance of less than 1%. The regression model explained only .6% of the variance in length of stay for schizophrenic cases (the largest single psychotic diagnostic subcategory) and 2%

for affective psychosis (a functional psychosis subcategory with about half as many cases as in the schizophrenic subcategory).

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